PECANWOOD

COLLEGE

Prepared for Life

INFORMATION TECHNOLOGY THEORY – GRADE 11

NAME: Memo: _____ **GRADE:** _____

DATE: 19 JULY 2023
EXAMINER: MR SC EILERTSEN
MODERATOR: MR C SEEWALD

MARKS: 145
TIME: 3 HOURS

INSTRUCTIONS:

1. This examination is made up of 16 pages.
2. Separately there is a reference document with the scenario and the addendums. This is 4 pages. Make sure your examination paper is complete.
3. A non programmable calculator may be used.
4. There are additional blank pages at the end of the examination.
5. For some questions (eg truth tables) it is suggested you use a dark pencil so that you can edit your work if necessary.
6. It is in your interests to write **neatly and clearly**. Please do not write too small.

Section A **Short Questions – Hardware, System Software**

Question One

Match the term in column A with its definition in column B. Use the answer grid below for your answers. Write the letter next to the question number. There is more definitions than terms.

	Column A		Column B
1.1	Interrupt	A	The time lost between the request being made and the data being available
1.2	Virtual memory	B	When more than one task in the same program can be executed at the same time. Each thread can be executed by a separate CPU (actual CPU or by hyperthreading)
1.3	latency	C	A signal sent to the CPU from hardware indicating the need for the CPU's attention.
1.4	Internal bus	D	That part of the OS that always resides in RAM and handles input/output requests, memory and peripherals e.g. keyboards
1.5	Cloud storage	E	A hardware or software component that stores data so that future requests for that data can be served faster;
1.6	SATA	F	Most peripherals connect to computers using this standardized connection technology. Additionally this connection provides power as well as data transfer.
1.7	multithreading	G	An older bus design used to connect secondary storage devices to the computer
1.8	cache	H	The address bus, the data bus and the control bus.
1.9	External buses	I	The PCI express, SATA, USB, NVMe,
1.10	kernel	J	Using a second set of registers in the CPU instructions can be pre-fetched from RAM – this speeds up the performance of a computer
		K	When part of secondary memory is used when primary memory is running low.
		L	A computer's ability to load more than one program into primary memory. Users can switch between programs.
		M	This bus design is most often used to connect graphic cards, Wi-Fi cards or SSD to the motherboard.
		N	When your computer is connected to a remote computer on the internet and you save your files to this remote computer.

(10)

Ques	Ans	Ques	Ans	Ques	Ans	Ques	Ans	Ques	Ans
1.1	C	1.2	K	1.3	A	1.4	H	1.5	N
1.6	G	1.7	B	1.8	E	1.9	I	1.10	D

[10]

Section B Multiple Choice – Networking, Internet

Question Two

In each case select the most correct answer.

2.1) This is when signals on one UTP cable interfere with signals on a neighbouring cable. This is called . . .

A) Eavesdropping
B) Attenuation
C) Crosstalk
D) Electro-Magnetic Interference

2.2) Select the one statement below that is **not** correct

A) Microwave, ethernet, Bluetooth and radio waves are examples of unbounded media.
B) Infrared, Bluetooth, microwave and radio waves are examples of unbounded media.
C) Radio waves, microwave, light, infrared and electromagnetic induction are all examples of unbounded media.
D) Near field communication, Bluetooth, radio waves and microwave are examples of unbounded media

2.3) Which of the following is an example of an MAC address that would be burnt onto the network card of a computer - bold has been used to assist readability.

A) 216.27.61.137
B) 2001:cdba::3257:9652
C) 00:0d:83:b1:c0:8e
D) java-teacher.com

2.4) This protocol maps the IP address to the relevant domain name e.g. 123.45.99.168 is mapped to the website called "java-teacher.com"

A) ARP
B) TCP/IP
C) DHCP
D) DNS

2.5) You are using WhatsApp to talk to a friend overseas i.e. you are therefore using your data and the internet – this is called VOIP. Which protocol would be used to enable the call?

A) TCP
B) UDP
C) FTP
D) DNS

Question	2.1	2.2	2.3	2.4	2.5
Answer	C	A	C	D	B

2.6) Your LAN goes from 15 nodes to 50 nodes and your network performance degrades. Therefore, you divide your network into two different segments – 25 computers on each segment. Which device do you use to join the segments together?

A) A router
B) A repeater
C) A bridge
D) A gateway

2.7) Which of the lists below is a list of email protocols

A) SMTP, POP3, IMAP
B) HTTP, HTTPS
C) FTP, WebDAV
D) TCP, UDP

2.8) If a business is in two different buildings 3 kilometres apart and each building is visible to the other, the best way to join them into the same computer LAN would be . . .

A) UTP cabling
B) Satellite
C) fibre optic cabling
D) Microwave

2.9) Microsoft Office is an example of . . .

A) Web based application
B) Mobile website
C) Mobile application
D) Cloud computing

2.10) Refer to addendum C which represents an audio clip. Which of the following statements are **incorrect.**

A) A is an analog signal, while B and C are digital signals
B) All three could potentially sound the same
C) Image B is an example of lossy compression
D) Image C has the smaller sample rate

Question	**2.6**	**2.7**	**2.8**	**2.9**	**2.10**
Answer	C	A	D	A	D

(10)

From here onwards the questions are based around the scenario unless otherwise stated.

Read the scenario now. You will find it in the "Reference Document"

Question Three **Application**

From here onwards make sure that your answers are based on the scenario unless the question states otherwise.

3.1) Some educators produce text-based materials while other produce videos. The type of computer each will use will by necessity be quite different. In your answer cover hardware, memory (cache, primary and secondary), input and output devices, portability, and access to the internet. You don't need to answer in full sentences. Use "A" and "B" to refer to the different computers. Although using **numbers** and units (e.g. Ghz) in your answer is good, for once, you may also use words like bigger, smaller, more, less, minimum, maximum, less than, more than, faster, slower etc. I suggest planning for this question and perhaps answering in pencil

Computer for text-based material - A	Computer for video-based material - B
Hardware A – i5 2,5Ghz B – i7 4,0Ghz. A – CPU with at least 2 cores capable of hyperthreading. B - CPU with at least 4 cores with hyperthreading A can have a standard (onboard) video card. B needs a dedicated graphics card with it own processor and RAM	
Memory (cache, primary and secondary) A- 8Gb RAM B – 16 Gb RAM primary memory A less L1, L2 and L3 cache memory B a lot more L1, L2 and L3 cache memory A - needs only a standard hard drive for file storage B - needs a fast SSD harddrive as well as a standard HDD	
Input/output devices Both need keyboards and mouse A needs a standard monitor. B needs a high resolution monitor that is bigger with a faster refresh rate. B needs a good quality microphone and speakers (built in or external)	

Portability A can be a laptop. B should be a desktop as high end laptops are very expensive
Access to the internet A if it is a laptop would need to access the internet via WiFi B if it is a desktop would be better served with a NIC, a LAN and a router

Question Three **Application of the scenario**

From here onwards make sure that your answers are based on the scenario unless the question states otherwise.

3.1) Some educators produce **text-based materials** while others produce **videos**. The type of computer each will use will by necessity be quite different. In your answer cover hardware, memory (cache, primary and secondary), input and output devices, portability, and access to the internet. You don't need to answer in full sentences. Use "A" and "B" to refer to the different computers. Although using **numbers** in your answer is **good**, for once, you may also use words like bigger, smaller, more, less, minimum, maximum, less than, more than, faster, slower etc. I suggest careful planning for this question and perhaps answering in pencil

Computer for text-based material - A	Computer for video-based material - B
3.1.1) Hardware	
3.1.2) Memory (cache, primary and secondary)	
3.1.3) Input/output devices	

More on next page

3.1.4) Portability

3.1.5) Access to the internet

3.1.6) Examine addendum A.
You will see that the CPU is linked to something called "Main memory". This term is extremely vague. Explain exactly what "main memory" is – refer and compare computer A to computer B and how "main memory" affects overall computer performance.

(15)

3.2) RAM (DRAM) memory is relatively slow when compared to the other sub-systems on a computer.

3.2.1) Explain why DRAM is relatively slow. It is a capaciter + needs to be constantly refreshed. Refreshing is done at a slower clock speed than the CPU. (1)

3.2.2) Explain how SRAM, L1 cache, L2 cache and L3 cache addresses this performance issue. Assume for this question that L3 cache is to be found on the motherboard itself.

SRAM is refreshed at the same speed as the CPU clock and is therefore much faster than DRAM L1 cache is fast memory inside the CPU and is therefore very fast. L2 cache is still inside the CPU but ~~is~~ runs slower than L1. L3 is faster than RAM because it is not at the end of the data bus. (4)

3.3) "Video files are extremely large and even a powerful computer can run out of RAM memory forcing it to use virtual memory – see addendum B – the use of virtual memory will impair performance if the computer has a mechanical hard drive. A solution is to use the **NVMe bus** and the **M.2 format** solid state hard drive (SSD)". Explain this statement and additionally, refer to the **SATA** bus in your answer.

A HDD fitted to the old SATA bus is slow. By fitting a fast SSD to the M.2 slot on the motherboard performance is greatly enhanced. M2 slot is attached to the new NVMe bus which is much faster than SATA (4)

[24]

Question 4 **System Software**

4.1) Since 1981 BIOS enabled computers to boot up. In 2004 UEFI was introduced which offered the computer many advantages over BIOS. List 4 advantages of UEFI over BIOS.

Can boot off drives larger than 2GB
Has its own GUI + memory system
Is mouse enabled.
Is 64 bit and therefore boots up faster.
Secure boot avoids rootkit malware
More options + easy to use. (4)

4.2) "Multiprocessing is offered by hardware. Multitasking is offered by software". Explain this statement and explain the difference between multiprocessing and multitasking.

Multiprocessing is parallel processing and needs multiple hardware CPUs or multiple cores within the CPU.
Multitasking is having multiple programs running at the same time - this is achieved by software - the OS. (5)

4.3) With regard to coding, define source code and object code, Source code is the english based code written by the programmer Object code is machine code produced by the compiler or interpretor (2)

4.4) With specific reference to Java, define bytecode and what makes it different to source and object code

Bytecode is compiled from source code. The JVM then interprets the bytecode into object code. Source code is English based. Object code is machine based (5)

4.5) Cross out the terms that do not apply to Java.

~~Low-Level language~~	High-Level language	~~Compiled language~~	Interpreted language

(2)

Bytecode is intermediate, between source code and object code. [14]

Question 5 Networking

5) HMT decides to use wiki software for its text-based material (Wikipedia is an example of a wiki in action). Twenty educators respond to learner's questions that have been posted. They create . . .

- One-page wikis on every topic covered in the South African school syllabus.
- Short videos explaining the relevant topic. The wikis link to these videos.
- Supportive content and solutions around the exam papers stored on their portal

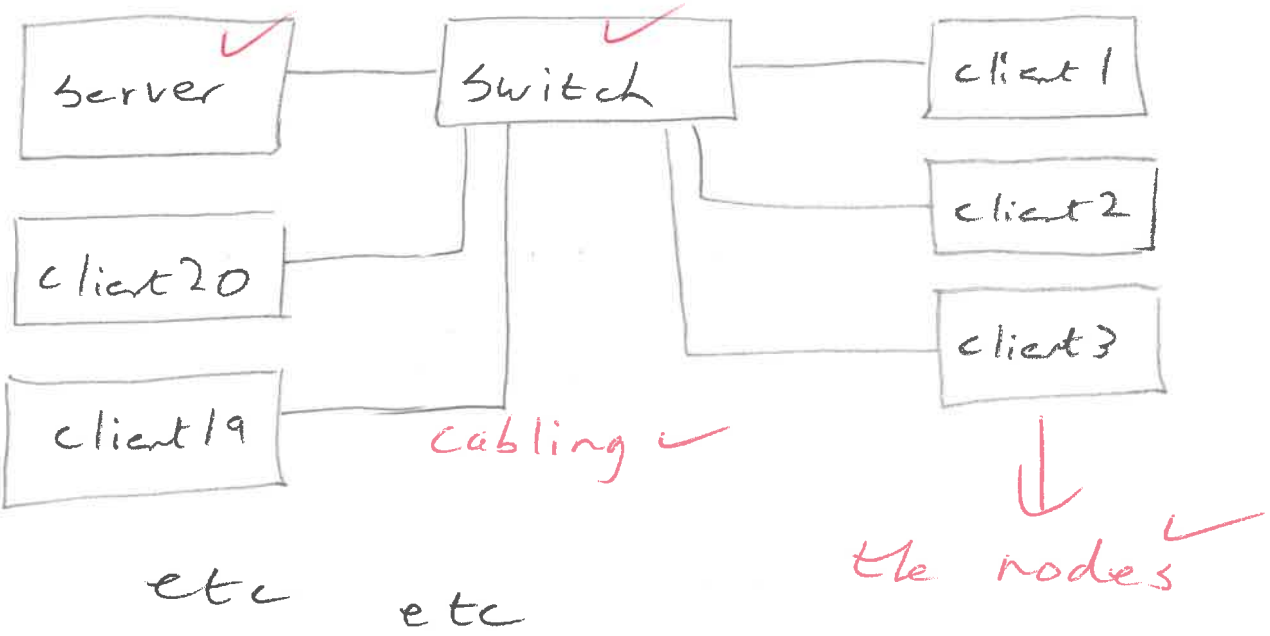
If you need more information about wikis, check out Addendum D.

5.1) "The building in Pretoria is going to have a **client-server** model using an **Ethernet** technology built on a **star topology** with **20 workstations**." Explain what is meant by this statement – focus on the words in bold.

The wiki software will be hosted on a server and the 20 educators (the clients) will access the wiki, creating content. This is an ethernet LAN – its provides connectivity between the server and the nodes. Each node has its own cable (6)

5.1.1) Below make a drawing, with labels, to illustrate your answer above.

connecting it to the switch – this is a star topology



(4)

5.2) Like most ethernet LANs the bounded media of choice will be UTP cabling.

5.2.1) A star topology in combination with UTP cabling offers several advantages. List three of them.

Cabling is cheap + easy to install
One fault in one place will not bring down the LAN
Easy to maintain / troubleshoot / add + remove nodes (3)

5.2.2) List three disadvantages of UTP cabling. Length of cable cannot be more than 100m (attenuation)
Eavesdropping, crosstalk and EMI
Labour intensive to install

(3)

5.3) Have a close look at **addendum F** showing two diagrams of a simple LAN.

5.3.1) Explain what the switch does when used in a star topology. It provides connectivity between the server and the client. It provides peer to peer communication (not broadcast) thus reducing network traffic (3)

5.3.1) Does a switch also perform the same function as a repeater. Yes or No. Yes (1)

5.3.2) Which device illustrates a switch – diagram 1 or 2. Explain your choice. 1. Peer to peer communication

(2)

5.3.3) One of the nodes on the LAN is a printer. If I want to print a document, which networking device is more efficient – device 1 or 2? Explain your choice.

1. Other nodes are bothered by the communication between the node and the printer. (2)

5.4) The client server model allows a private intranet to be created that the educators (who work for HMT) can access, even from home. The wiki software is loaded onto the private server. Once a day the whole wiki (and all its pages) are copied off the intranet and onto a public server for learners to access via the internet using their browser. Once learners have logged into the system, they can post questions, read answers, and interact with one another.

5.4.1) The philosophy behind the digital revolution is for software to achieve 5 goals - **collaboration, communication, productivity, security, and synchronisation.**

Carefully re-read the scenario and the relevant addendums.

HMT has made hardware, software and networking choices. Explain how they have achieved these five goals.

All 5 are achived by a client server model — ie an Ethernet LAN using a switch with a star topology. The wiki is loaded onto the server — all the educators can collaborate on every topic. Communication + productivity are achieved between the educators via email etc. Wiki software automatically achieve synchronisation — each wiki page is created/updated and everybody immediately has access to the new material. Security is achived by logging in via a username and a password. There are always two copies of the wiki — one on the server on the intranet and the other is on the public server on the internet. Productivity is also achieved by wiki pages, videos and hyperlinks. Learners are linked to existing answers without the educators having to answer the same question repeatedly. Learner communication is achieved by a social media application. Educators can work from home facilitating productivity (12)

5.4.2) List two disadvantages or weaknesses that you can see, (your opinion) in the HMT setup and business model.

Various.
Copyright. Plagarism.

(3)
[39]

Question 6 **Internet**

6.1) Is HMT an example of Web 1.0, Web 2.0 or Web 3.0? Explain your choice giving examples.

Web 2.0. Read-write community. Wikis
Sharing content are all part of Web 2.0
Web 3.0 is portable and all about the
individual (not the group)

(3)

6.2) Explain why HMT mainly makes use of **server-side scripts** to fulfil the requests of the learners

The login process. Specific searches and
pages being requested.

(4)

6.3) Explain what a cookie is. A small piece of data from a
website stored in a user's browser.
The data in the cookie is used to notify
the website of the user's previous activity (3)

6.4) HMT is a web-based application. Give 4 advantages of web-based applications.

No need to purchase & install software
Up to date
Accessed from anywhere on any device
Independat of the OS in use

(4)

6.5) HMT understands that many learners do not have a computer but instead will want to access HMT using their phones.

6.5.1) What are the challenges of trying to use HMT on a smart phone rather than on a full-size computer?

No keyboard. Small screen size. Lack of computing power. Lack of local storage. Difficult to navigate if poorly designed. The performance can be slow. Different screen resolutions. Screen sensitivity can be a problem. (4)

6.5.2) For this reason HMT want to create a mobile version of their wiki. In what ways will the mobile version be different?

Better navigation. Big images and unnecessary files are removed. Layout customised to the size and orientation of a smart phone. (3)

6.5.3) Wiki software is "responsive". In the context of this question explain what this means

Responsive software detects the device and its size and alters the website accordingly. (2)

[22]

Question 7 **Errors, threats and security**

7.1) HMT will have calculators that learners can use embedded into their wiki pages. Some answers will be extremely small as in molecules and atoms, while other answers will be extremely large as in physics or astronomy.

This brings us to different types of arithmetic errors HMT could accidentally offer learners.

Explain the following arithmetic errors

7.1.2) Rounding Any form of rounding a number makes it less accurate. (1)

7.1.3) Truncating When the decimal part of the number (smaller than one) is removed leading to inaccuracy. (1)

7.1.4) Fixed number of bits. The number of bits needed to represent a number is not enough. Example: The value of Pi (2)

7.1.5) Overflow. When a number increases or decreases and needs more bits for accuracy but more bits are not available. (2)

7.2) The HMT servers ask learners to register onto the system. Their replies must be **validated**. Here are 7 different types of validation – **presence, range, uniqueness, length, type, format and logical.**

Learner Naledi Sefika is a female learner at Pecanwood College. She was born on 28 February 2010 and is in grade 10. In the table validate her responses according to the 7 types of validation given

The HMT questions. (All questions are compulsory to register)	**Her response**	**Valid or invalid. If invalid – give the reason (one of the seven above)**
First Name:	N length	Invalid. Not her name. It is too short.
Last Name:	Sefika	Valid.
Gender: M/F or N/A	None type	Invalid. None is not a valid answer in the context of this question
School:	 presence	Invalid. Answer is not there (all are compulsory)
Grade:	20 range	Invalid answer. Grade 20 does not exist.
Date of birth: dd/mm/yyyy	29 February 2010 format. logical	Invalid - Wrong format. 29 February 2010 does not exist – not a leap year.

(7)

7.4) Study the pseudocode in addendum G which is part of the algorithm to test to see if Naledi Sefika's date of birth is valid (see question 7.2) There are some problems with this code. Correct the code so that it is correct and logical. You must use pseudocode in your answer (not Java)

```
day ← 29                    Indicate problem with 28/29 ✓
month ← 2
year ← 2016                 indetation ✓
if day between 1 and 31
    flag1 = true
if month between 1 and 12
    flag2 = true
if year between 2008 and 2012
    flag3 = true
if flag1 and flag2 and flag3
    display "Valid date of birth"
```

(5)

7.3) Using a truth table, showing all possible values prove that . . .

(B'.A'.O')' is not equal to (B + A + O)'

B	A	O						
0								
0	0	0	(0'.0'.0')'	(1)'	0	(0+0+0)'	(0)'	1
0	0	1	(0'.0'.1')'	(0)'	1	(0+0+1)'	(1)'	0
0	1	0	(0'.1'.0')'	(0)'	1	(0+1+0)'	(1)'	0
0	1	1	(0'.1'.1')'	(0)'	1	(0+1+1)'	(1)'	0
1	0	0	(1'.0'.0')'	(0)'	1	(1+0+0)'	(1)'	0
1	0	1	(1'.0'.1')'	(0)'	1	(1+0+1)'	(1)'	0
1	1	0	(1'.1'.0')'	(0)'	1	(1+1+0)'	(1)'	0
1	1	1	(1'.1'.1')'	(0)'	1	(1+1+1)'	(1)'	0

✓ ✓ ✓ ✓ ✓ (7)

[25]

GRAND TOTAL: 145

Additional Paper 1: Please label your answers clearly